Syllabus
Physics 498 BP Biophysics Lab
Spring Semester 2017

Instructors: Paul Selvin, selvin@illinois.edu; Jaya Yodh, jyodh@illinois.edu
TAs: Marco Tjioe, tjioe2@illinois.edu; Duncan Nall, nall2@illinois.edu; Chaoyi Jin, cjion8@illinois.edu; Yuji Ishitsuka, yuji@illinois.edu

Prerequisites: None; Credit: 4 hrs

Lectures: Mon 4:00-4:50 pm, Loomis 322 (except Jan. 17 in Loomis 464)
Labs: Tuesdays or Thursdays 1:00-4:50 pm (see locations below)

Groups A-D consist of 4 students each/group

Website: https://courses.physics.illinois.edu/phys498BP/

Course Format

- 6 experimental labs will be offered. Each lab is taught over 2 weeks to 4 groups of 4 students each. The hands-on experiments and analysis will be mixed over each 2 week period (e.g. – 6 hr. total of taking data & 2 hr. of analysis). Students will finish remainder of the analysis on their own and turn in a lab report for each lab.
- Lectures for each lab will be taught on Mondays.
- The course will end with required student presentations following these general guidelines: Graduate students will present on their own research and a possible application learned from this course, while undergraduate students will present on a recent paper using one of the techniques taught in this course.

LAB TOPICS

Lab 1: Ensemble Fluorescence
Location - Loomis 328; Instructor(s) - Marco Tjioe, tjioe2@illinois.edu
Part 1: Dye absorption, emission, lifetime, anisotropy
Part 2: Bulk FRET, donor-acceptance donor

Lab 2: Bright Field & Fluorescence Microscopy
Location – Institute for Genomic Biology (IGB) Core Facilities; Instructor - Jaya Yodh, jyodh@illinois.edu
Part 1: Brightfield, Kohler illumination DIC, Phase Contrast, Fluorescence Microscopy
Part 2: Widefield fluorescence 3D stack and deconvolution

Lab 3: FIONA
Location - Loomis 328; Instructor(s) - Chaoyi Jin, cjion8@illinois.edu
Part 1: Photobleaching Lifetime Dye-DNA,
Part 2: Kinesin Q-dot step size measurement; Matlab Code and FIONA analysis

Lab 4: Optical Traps or Light Sheet Microscopy (LSM)
Location (optical traps) Loomis 328 (Selvin Lab); (Light Sheet Microscopy) IGB Core Facilities
Instructors - Chaoyi Jin, cjion8@illinois.edu; Duncan Nall, nall2@illinois.edu

Lab 5: STORM/PALM
Location - Loomis 328; Instructors – Duncan Nall, nall2@illinois.edu; Marco Tjioe, tjioe2@illinois.edu
Part 1: Microtubule-Cy3b imaging using PALM principles. Imaging and Analysis
Part 2: Microtubule Ab-label (2-color) STORM. Imaging and Analysis

Lab 6: smFRET
Location – Loomis 108; Instructors: Jaya Yodh, jyodh@illinois.edu; Yuji Ishitsuka, yuji@illinois.edu
Part 1: TIRF optics, Slide Pegylation, Chamber Setup, smFRET experiment intro
Part 2: GQ folding experiment and Fret histogram, trace and HaMMMy analysis

LECTURE & LAB SCHEDULE SPRING 2017
<table>
<thead>
<tr>
<th>Week (M-F)</th>
<th>Monday (4:00-4:50 pm)</th>
<th>Tuesday (1:00-4:50 pm)</th>
<th>Thursday (1:00-4:50 pm)</th>
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<tbody>
<tr>
<td>Jan 16-20, 2017</td>
<td>1/16/17 MLK HOLIDAY</td>
<td>• COURSE ORIENTATION 1:00-2:30pm, Loomis 464</td>
<td>• Lecture 1:00-2:30 pm Loomis 322</td>
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| Jan 23-27, 2017 | Lecture 2 | • Lab 1, Pt 1 - Ensemble Fluorescence (Grp A)  
• Lab 2, Pt 1 - Bright Field & Fluorescence Microscopy (Grp B) | • Lab 1, Pt 1 - Ensemble Fluorescence (Grp C)  
• Lab 2, Pt 1 - Bright Field & Fluorescence Microscopy (Grp D) |
| Jan 30 – Feb 3, 2017 | Lecture 3 | • Lab 1, Pt 2 - Ensemble Fluorescence (Grp A)  
• Lab 2, Pt 2 - Bright Field & Fluorescence Microscopy (Grp B) | • Lab 1, Pt 2 - Ensemble Fluorescence (Grp C)  
• Lab 2, Pt 2 - Bright Field & Fluorescence Microscopy (Grp D) |
| Feb 6-10, 2017 | Lecture 4 | • Lab 1, Pt 1 - Ensemble Fluorescence (Grp B)  
• Lab 2, Pt 1 - Bright Field & Fluorescence Microscopy (Grp A) | • Lab 1, Pt 1 - Ensemble Fluorescence (Grp D)  
• Lab 2, Pt 1 - Bright Field & Fluorescence Microscopy (Grp C) |
| Feb 13-17, 2017 | BPS MEETING FROM FEBRUARY 11-17, 2017 NO LECTURE/LABS | | |
| Feb 20-24, 2017 | Lecture 5 | • Lab 1, Pt 2 - Ensemble Fluorescence (Grp B)  
• Lab 2, Pt 2 - Bright Field & Fluorescence Microscopy (Grp A) | • Lab 1, Pt 2 - Ensemble Fluorescence (Grp D)  
• Lab 2, Pt 2 - Bright Field & Fluorescence Microscopy (Grp C) |
| Feb 27-Mar 3, 2017 | Lecture 6 | • Lab 3, Pt 1 – FIONA (Grp A)  
• Lab 4, Pt 1 – Optical Traps or Light Sheet Microscopy (Grp B) | • Lab 3, Pt 1 – FIONA (Grp C)  
• Lab 4, Pt 1 – Optical Traps or Light Sheet Microscopy (Grp D) |
| Mar 6-10, 2017 | Lecture 7 | • Lab 3, Pt 2 – FIONA (Grp A)  
• Lab 4, Pt 2 – Optical Traps or Light Sheet Microscopy (Grp B) | • Lab 3, Pt 2 – FIONA (Grp C)  
• Lab 4, Pt 2 – Optical Traps or Light Sheet Microscopy (Grp D) |
| Mar 13-17, 2017 (APS) | Lecture 8 | • Lab 3, Pt 1 – FIONA (Grp B)  
• Lab 4, Pt 1 – Optical Traps or Light Sheet Microscopy (Grp A) | • Lab 3, Pt 1 – FIONA (Grp D)  
• Lab 4, Pt 1 – Optical Traps or Light Sheet Microscopy (Grp C) |
| Mar 20-24, 2017 | SPRING BREAK | | |
| Mar 27-31, 2017 | Lecture 9 | • Lab 3, Pt 2 – FIONA (Grp B)  
• Lab 4, Pt 2 – Optical Traps or Light Sheet Microscopy (Grp A) | • Lab 3, Pt 2 – FIONA (Grp D)  
• Lab 4, Pt 2 – Optical Traps or Light Sheet Microscopy (Grp C) |
| Apr 3-7, 2017 | Lecture 10 | • Lab 5, Pt 1 – STORM (Grp A)  
• Lab 6, Pt 1 – smFRET (Grp B) | • Lab 5, Pt 1 – STORM (Grp C)  
• Lab 6, Pt 1 – smFRET (Grp D) |
| Apr 10-14, 2017 | Lecture 11 | • Lab 5, Pt 2 – STORM (Grp A)  
• Lab 6, Pt 2 – smFRET (Grp B) | • Lab 5, Pt 2 – STORM (Grp C)  
• Lab 6, Pt 2 – smFRET (Grp D) |
| Apr 17-21, 2017 | Lecture 12 | • Lab 5, Pt 1 – STORM (Grp B)  
• Lab 6, Pt 1 – smFRET (Grp A) | • Lab 5, Pt 1 – STORM (Grp D)  
• Lab 6, Pt 1 – smFRET (Grp C) |
| Apr 24-28, 2017 | Lecture 13 | • Lab 5, Pt 2 – STORM (Grp B)  
• Lab 6, Pt 2 – smFRET (Grp A) | • Lab 5, Pt 2 – STORM (Grp D)  
• Lab 6, Pt 2 – smFRET (Grp C) |
| May 1-5, 2017 | • Student Presentations (3:00-5:00 PM)  
• Student Presentations (1:00 – 4:00 PM) | | • No Class Last Day of Instruction Wed, May 3  
• Reading period begins Thurs. May 5 |
| May 8-12, 2017 | NO FINAL EXAM; May 19, 2017 GRADES DUE | | |